Drafting Machine Controls and Machine Head Operation

DRAFTING MACHINE CONTROLS AND MACHINE HEAD OPERATION
Drafting machine heads contain the controls for horizontal, vertical, and angular movement. Although each brand of machine contains similar features, controls may be found in different places on different brands (see Figure 1). Most machines have the following controls:

- **Baseline adjustment**—releases the scales so they can move but the protractor is not affected.
- **Index control**—permits automatic stops every 15°. You can also push in and lock the index control to let you adjust the machine to any angle.
- **Indexing clamp**—locks the protractor at angles other than 15° increments so you can draw an accurate line without the protractor moving.

![Figure 1](image)

**FIGURE 1.** Drafting machine head controls and parts. *Courtesy Vemco Corporation.*

Machine Operation
To operate the drafting machine protractor head, place your hand on the handle and use your thumb to depress the index control button. Doing so allows the head to rotate. Each increment marked on the protractor is 1 degree, with a label every 10°. As the vernier plate (the small scale numbered from 0 to 60) moves past the protractor, the zero on the vernier aligns with the angle that you want to read. For example, Figure 2 shows a reading of 10°. As you rotate the handle, notice the head automatically locks every 15°. To move the protractor past the 15° increment,
you must again depress the index control button. A **vernier**, also called a **vernier scale**, is a small, movable auxiliary graduated scale attached parallel to a main graduated scale, calibrated to indicate fractional parts of the subdivisions of the larger scale and used on certain precision instruments to increase accuracy in measurement.

**FIGURE 2.** Vernier plate and protractor showing a reading of 10°.

Figure 3 shows the position of the machine after rotating the protractor head 40° clockwise. The vernier plate at the protractor reads 40°, which means that both the horizontal and vertical scale have moved 40° from their original position at 0° horizontal and 90° vertical. The horizontal scale reads directly from the protractor starting from 0°. The vertical scale reading begins from the 90° position. The key to measuring angles is to determine if the angle is measured from the horizontal or vertical starting point (see Figure 4.)
FIGURE 3. Angle measurement with the drafting machine.
FIGURE 4. Angle measurements with either a horizontal or a vertical reference line.

To measure full-degree increments, match the zero mark on the vernier plate with a full-degree mark on the protractor. See the reading of 12° in Figure 5. The vernier scale allows you to measure angles as accurately as 5' (minutes). Remember, 1 degree equals 60 minutes (1° = 60'), and 1 minute equals 60 seconds (1' = 60").

FIGURE 5. Measuring full degrees.

**Reading and Setting Angles with the Vernier**

To read an angle other than a full degree, assume the vernier scale is set at a positive angle as shown in Figure 6. Each mark on the vernier scale represents 5'. First, see that the angle to be read is between 7° and 8°. Then find the 5' mark on the upper half of the vernier, or the direction in which the scale has been turned, that is most closely aligned with a full degree on the protractor. In this example, it is the 40' mark. Add the minutes to the degree just passed. The correct reading, then, is 7°40'. The procedure for reading negative angles is the same, except you read the minute marks on the lower half of the vernier.

To set the angle 7°40', for example and as shown in Figure 6, first release the protractor brake and disengage the indexing mechanism with the thumb control. Rotate the protractor arm counterclockwise until the zero of the vernier is at 7°. Then slowly continue the rotation until the 40' mark on the upper half of the vernier aligns with the nearest degree mark on the protractor. Lock the protractor brake and draw the line. The procedure for setting negative angles is essentially the same except for turning the protractor head in a clockwise direction and reading the lower half of the vernier.

FIGURE 6. Reading positive angles with the vernier.
**Machine Setup**
To insert a scale in the baseplate chuck, place the scale flat on the board and align the scale chuckplate with the baseplate chuck on the protractor head. Firmly press but do not drive the scale chuckplate into the baseplate chuck. To remove a scale, use the scale wrench provided with the machine. Removing a scale by hand without the aid of a key could result in damage to the scale or the machine. Refer to the operation manual provided with your drafting machine.

**Scale Alignment**
Before drawing with any drafting machine, check the scales for alignment and make any needed adjustment so the scales are at right angles to each other. For best results with a track drafting machine, the scales should also be aligned with respect to the horizontal track. Follow the instructions provided with your operation manual to accomplish both operations.